University of Colorado
Department of Computer Science

Chaotic Dynamics – CSCI 4446/5446

Final Project — Details

Please obtain and read a copy of the *Project Guidelines* handout (available from the class web page) if you have not yet done so. Projects are required for CSCI 5446 people, and will be the basis for 40% of their final grades for the class. Undergrads are welcome to take on a small project if they're interested or to boost a low grade. Any undergrad who is thinking about this should come talk to me about it **before spring break**.

Any code that is used in a project will count in place of the grade *for the coding section only* of any missed problem sets that involved that code. That is, if you punted PS6 but wrote an adaptive Runge-Kutta integrator for your project, you can get full credit for the code part of PS6 by sending me a message explaining the situation. To get credit for the analysis part, however, you'll have to see me and convince me that you understand the issues involved.

To quote the *Project Guidelines* handout: a good project will consist of a short, self-contained, well-chosen piece of original, independent research. It must include both analysis (e.g., incorporation of the results of a literature search) and synthesis (e.g., building a circuit, embedding some real-world data, computing fractal dimensions or Lyapunov exponents, etc.) The synthesis component must be significant and woven well into the paper and the talk; writing six pages of analysis and tacking on some semi-related RK4 runs at the end as an afterthought is insufficient. The end result of the synthesis process must be to at least some extent *novel*; simple corroboration of what you read about in the literature is inadequate. The new results that you produce need not be of publishable caliber. A few past term projects in this course have attained that threshold, but that is an ideal, not a requirement. Ideally, your project will tie in to your own research, perhaps producing a chapter or proposal for your thesis. Cross-coupling with other courses is fine too (i.e., doing one big project that meets the requirements for both CSCI 5446 and some other course you're taking).

The purpose of the one-paragraph project description, due a few weeks before spring break, is to give you an opportunity to formulate your thoughts and to let me know what you're planning. It need not cite references, but should be the product of some literature searching, a few hours of reading, and a few hours of thought.

During the week after you submit this paragraph, we will have a short one-on-one meeting to discuss your project. I will answer any questions I can, give you all the pointers to references on your chosen topic that I can think of, advise you as to its apparent size, difficulty, and appropriateness, and perhaps suggest a different slant to fix any such problems.

If you choose an area that I don't know much about (e.g., maps, solitons), be forewarned that I may not be able to accurately assess the amount of work involved or give you good pointers! Such projects are *not* discouraged, but they may be unpredictably difficult; you may wish to get advice from other, more-qualified people before embarking upon them.

The one-page proposal, due on the thursday after spring break, should be the product of several afternoons of background research, a week of thought, and an evening or two of writing. It must include — and properly cite — a preliminary bibliography, and it must be well-written: introduction, body, conclusion; topic sentences at the beginning of each paragraph; footnotes

where appropriate; proper usage, spelling, grammar; etc. The one-page limit is a guideline, not a hard limit; it does not include the bibliography, and may be exceeded if the alternative is microscopic font or spacing. Your proposal must clearly identify which of the computer tools that you built over the course of the semester will be used — and how — in the project. Finally, it must describe what new contributions may result from the work. No changes in topic will be permitted after this proposal has been accepted.

The purpose of the in-class presentations — which occur during the penultimate week of class — is threefold: (1) to let the rest of the class learn from what you did (2) to give me a mental outline for my 2 a.m. session with your paper and (3) to help you learn the essential skill of presenting your ideas to others. It will also provide a great opportunity for last-minute course corrections: with this group, you will probably get lots of good comments if anything is the slightest bit uncertain or unclear.

This presentation should be understandable to the undergrads *as well as interesting to the grads* (this is hard!) and should be professionally prepared with slides, computer or physical demos, etc. You need not present *all* of your final results at this time — you'll have another week or so to finish those up before the paper due date — but you must describe the main themes of your research questions and of your findings, present the *majority* of the results of the original work (e.g., numerical experiments) that you proposed, and discuss how the themes, questions, and results tie in together. *Inclusion of a "research question" slide is mandatory, as well as a return to that question at the end of your talk (i.e., what was your answer to that question?)*

A time limit will be strictly enforced. Please tailor your presentation to allow two minutes' worth of leeway for questions and such; practice in front of an audience and get the timing and slide shuffling down. And please take a close look at the "presentation hints" document that is posted on the class website.

Your slides are due to me by email before midnight of the day before your presentation. They must be in pdf or ppt(x) format. You may also bring them on a USB drive. If you choose this option, please arrive ten minutes early. We will be projecting from my Mac OSX laptop so we don't lose time swapping cables. If your presentation requires unusual software that may not exist on that machine, please check with me ahead of time.

Undergrads will turn in single-paragraph reports on each oral presentation; I'll cut'n'paste these reports and send the operative bits to each project's author. This should give you a good (and often hilarious) idea of which parts of your presentation came across well, or not.

The final paper, due by the last day of classes, should be a well-written formal research report. This document must present the polished, final product of your research accurately and well, integrate and answer any comments and questions that were raised during the in-class presentation, and adhere to a word-count limit of 2500 words, not including figure captions, footnotes, and embedded text formatting commands. (Compute this, for example, using `detex` and the unix `wc` command or something similar.) The word-count limit should give you some serious incentive to use figures to tell as much of the story as possible. *Scientific American* articles, for instance, are designed so a knowledgeable person can get their gist simply by looking at the figures and reading their captions.

20% of your grade for the final project will be based on the in-class presentation, 30% on the paper, and 50% on the union of the content of both.